

GA 400 Scenario Analysis

The future year 2030 no build analysis indicates that the most of existing side-street along GA 400 will not have capacity to handle the projected traffic growth in the study area and hence the impact on GA 400 could not be estimated.

ARCADIS performed traffic analysis for three defined scenarios along GA 400. The three scenarios that were evaluated are

- Scenario 1: Six lane freeway system between Keith Bridge Road (SR 306) and SR 60
- Scenario 2: Eight lane freeway system between Keith Bridge Road (SR 306) and SR 60
- Scenario 3: Eight lane freeway system, including one HOV / Managed lane between Keith Bridge Road (SR 306) and Lumpkin Campground / Harmony Church Road and transitions to a six lane freeway system between Lumpkin Campground / Harmony Church Road and SR 60

Interchanges for the general purpose lanes will be provided at the following locations under all the modeled scenarios. Additional interchanges are provided for the HOV scenario.

Table 1. Interchange Locations along GA 400	
	Keith Bridge Road (SR 306)
	Browns Bridge Road (SR 369)
	Settingdown Road
	Hubbard Town / Cross Roads Road
	Whitmire Drive / Carlisle Road
	SR 53
	Lumpkin Campground / Harmony Church Rd
	SR 136
	Burnt Stand Road / Lumpkin County Parkway
	SR 60

GA 400 between Whitmire Drive / Carlisle Road and SR 53 was modeled with frontage road system and ramp access between GA 400 and the frontage roads under all the scenarios.

The traffic simulation and analysis to evaluate the various scenarios was performed using Corsim. Additionally, Synchro 7 was used to build the signal timing data for the

signalized intersections. Traffic flow was analyzed for morning and afternoon peak-hour conditions. The analysis, which was performed by simulation, resulted in the determination of density translated in to level of service for freeway segments and merge, diverge and weaving sections, existing peak-hour delays and corresponding levels of service for the ramp terminal intersections. Speed and travel time measures along the corridor are additional Measures of Effectiveness (MOE) that were obtained from the simulation model. These results would be used to evaluate the efficiency of traffic operations and also to identify other improvement needs.

The following sections discuss the results of analysis for each of the scenario.

Scenario 1: Six lane freeway system between Keith Bridge Road (SR 306) and SR 60

Under this scenario, GA 400 will operate as a freeway system with 3 lanes in each direction, between Keith Bridge Road (SR 306) and SR 60. The frontage road between Whitmire Drive / Carlisle Road and SR 53 is analyzed as 2 lanes in each direction.

There are no major improvements to the number of lanes along the side streets within the study area except at SR 53 and Browns Bridge Road (SR 369) in the vicinity of GA 400. The number of turn lanes and the turn bay lengths at the ramp terminal intersections were estimated in accordance with Highway Capacity Methodology (HCM) and American Association of State Highway and Transportation Officials (AASHTO). All the ramp terminal intersections under this scenario are analyzed as signalized intersections. Additionally, acceleration lanes for the heavy right turn movements at some of these intersections were provided, as needed, to improve traffic operations. The minimum length of acceleration and deceleration lanes along GA 400 was based on Highway Capacity Methodology (HCM), longer deceleration lengths were based on the heavy exiting traffic volumes. These assumptions were used to build the traffic simulation model. The future year 2030 volumes, developed by PBS&J, and free flow speed are the other data inputs to the simulation model.

The density and the corresponding level of service for the freeway segments and the ramp junctions for morning and afternoon peak hours are summarized in Tables 2 to 5. The vehicle delay during the morning and afternoon peak-hour based on each approach are summarized in Table 6. The intersection delay and the corresponding levels of service during the morning and afternoon peak-hours at the signalized intersections are summarized in Table 7. The delays are in terms of average vehicular delay per vehicle at a particular intersection. The level of service provides a qualitative assessment of traffic conditions, based on the average delay and density.

Table 2. Future Year 2030 AM GA 400 Mainline Level of Service Summary for Six Lane Scenario

Freeway Segment	Density		Level of Service	
	(Vehicles / Hr / Lane)		(LOS)	
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	18.8	27.9	C	D
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	14.1	43	B	E
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	12.8	23.7	B	C
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	11.6	22.8	B	C
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	10.9	22.8	A	C
GA 400, Between Dawson Forest Road (SR 318) and SR 53	8.6	18.4	A	C
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	11.5	22	B	C
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	10.3	19.5	A	C
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	8.9	15.8	A	B
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	7.3	14.8	A	B

Table 3. Future Year 2030 AM Merge, Diverge and Weaving Level of Service Summary for Six Lane Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	15	45	B	E
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	13	26	B	C
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	15	23	B	C
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	11	26	B	C
GA 400 Off Ramp at Settingdown Road	Diverge	13	23	B	C
GA 400 On Ramp at Settingdown Road	Merge	10	22	B	C
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	14	23	B	C
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	10	21	B	C
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	11	-	B	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	21	-	C
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	8	18	A	B
GA 400 On Ramp at Dawson Forest Road	Merge	8	-	A	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	19	-	B
GA 400 Off Ramp SR 53	Diverge	9	24	A	C
GA 400 On Ramp at SR 53	Merge	11	16	B	B
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	11	19	B	B
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	8	22	A	C
GA 400 Off Ramp at SR 136	Diverge	10	15	A	B
GA 400 On Ramp at SR 136	Merge	7	16	A	B
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	9	15	A	B
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	6	14	A	B
GA 400 Off Ramp at SR 60	Diverge	8	12	A	B
GA 400 On Ramp at SR 60	Merge	5	18	A	B

Table 4. Future Year 2030 PM GA 400 Mainline Level of Service Summary for Six Lane Scenario

Freeway Segment	Density		Level of Service (LOS)	
	(Vehicles / Hr / Lane)			
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	55.7	17.2	F	B
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	31	13.5	D	B
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	28.9	11.2	D	B
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	27.7	10	D	A
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	26.3	9.8	D	A
GA 400, Between Dawson Forest Road (SR 318) and SR 53	19.6	9.6	C	A
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	21.5	13.8	C	B
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	17.8	13.1	C	B
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	13.6	11.9	B	B
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	12.2	10.4	B	A

Table 5. Future Year 2030 PM Merge, Diverge and Weaving Level of Service Summary for Six Lane Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	55	13	E	B
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	30	16	D	B
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	33	11	D	B
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	25	12	C	B
GA 400 Off Ramp at Settingdown Road	Diverge	30	10	D	A
GA 400 On Ramp at Settingdown Road	Merge	25	10	C	A
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	28	10	C	A
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	24	9	C	A
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	28	-	C	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	9	-	A
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	19	8	B	A
GA 400 On Ramp at Dawson Forest Road	Merge	17	-	B	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	10	-	A
GA 400 Off Ramp SR 53	Diverge	21	15	C	B
GA 400 On Ramp at SR 53	Merge	20	9	B	A
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	22	13	C	B
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	15	13	B	B
GA 400 Off Ramp at SR 136	Diverge	18	11	B	B
GA 400 On Ramp at SR 136	Merge	11	11	B	B
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	14	10	B	A
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	11	11	B	B
GA 400 Off Ramp at SR 60	Diverge	14	9	B	A
GA 400 On Ramp at SR 60	Merge	8	13	A	B

Table 6. Future Year 2030 Approach Delay Summary for Six Lane Scenario

Signalized Intersection	2030 AM				2030 PM			
	Delay (Sec / Veh)				Delay (Sec / Veh)			
	NB	SB	EB	WB	NB	SB	EB	WB
SR 306 at GA 400 NB Ramp	18.5	0.0	19.2	161.0	94.0	0.0	38.2	46.8
SR 306 at GA 400 SB Ramp	0.0	62.9	75.7	157.7	0.0	72.5	34.3	31.4
SR 369 at GA 400 NB Ramp	31.4	0.0	8.8	10.5	27.5	0.0	13.5	13.1
SR 369 at GA 400 SB Ramp	0.0	44.0	16.7	17.3	0.0	29.4	10.7	10.2
Settingdown Rd at GA 400 NB Ramp	16.3	0.0	13.5	6.8	14.9	0.0	25.1	17.7
Settingdown Rd at GA 400 SB Ramp	0.0	17.1	12.5	23.6	0.0	19.6	12.0	29.6
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	128.6	0.0	18.9	15.8	30.9	0.0	16.7	16.4
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	0.0	36.8	13.7	25.0	0.0	28.8	10.7	14.3
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	23.0	0.0	11.5	9.1	24.0	0.0	14.2	8.6
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	0.0	27.2	8.4	11.5	0.0	28.4	10.0	13.0
Dawson Forest Road (SR 318) at Frontage Rd NB	39.4	0.0	11.4	9.3	39.8	0.0	15.9	15.3
Dawson Forest Road (SR 318) at Frontage Rd SB	0.0	26.4	13.0	16.1	0.0	36.0	10.2	12.4
Industrial Park Rd (SR 318) at Frontage Rd NB	20.3	0.0	7.1	6.6	24.4	0.0	11.4	9.5
Industrial Park Rd (SR 318) at Frontage Rd SB	0.0	27.4	6.6	8.8	0.0	27.0	5.8	9.1
SR 53 at GA 400 NB Ramp	26.8	0.0	11.3	10.4	22.4	0.0	15.3	12.1
SR 53 at GA 400 SB Ramp	0.0	29.0	11.3	10.5	0.0	22.2	13.4	14.7
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	33.9	0.0	7.9	3.3	25.2	0.0	13.3	13.5
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	0.0	20.2	9.6	24.4	0.0	20.8	7.8	27.0
SR 136 at GA 400 NB Ramp	21.8	0.0	11.4	5.7	21.8	0.0	16.8	11.4
SR 136 at GA 400 SB Ramp	0.0	22.6	6.5	7.4	0.0	23.3	5.0	7.7
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	22.2	0.0	11.6	9.6	25.4	0.0	13.3	10.3
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	0.0	22.3	6.8	11.8	0.0	22.3	8.2	12.9
SR 60 at GA 400 NB Ramp	35.2	0.0	12.6	30.1	29.2	0.0	40.0	68.5
SR 60 at GA 400 SB Ramp	0.0	36.3	13.0	23.5	0.0	42.9	7.8	19.1

Table 7. Future Year 2030 Intersection Capacity Analysis Summary for Six Lane Scenario

Signalized Intersection	Delay (Sec / Veh)		LOS	
	AM	PM	AM	PM
SR 306 at GA 400 NB Ramp	96.2	61.1	F	E
SR 306 at GA 400 SB Ramp	115.9	36.7	F	D
SR 369 at GA 400 NB Ramp	13.2	16.4	B	B
SR 369 at GA 400 SB Ramp	20.4	12.0	C	C
Settingdown Rd at GA 400 NB Ramp	10.7	19.8	B	B
Settingdown Rd at GA 400 SB Ramp	19.1	19.4	B	B
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	44.9	21.9	D	C
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	24.0	15.3	C	B
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	14.4	16.7	B	B
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	17.0	18.4	B	B
Dawson Forest Road (SR 318) at Frontage Rd NB	19.8	25.3	B	C
Dawson Forest Road (SR 318) at Frontage Rd SB	17.5	18.3	B	B
Industrial Park Rd (SR 318) at Frontage Rd NB	11.0	13.9	B	B
Industrial Park Rd (SR 318) at Frontage Rd SB	16.8	13.5	B	B
SR 53 at GA 400 NB Ramp	15.2	17.0	B	B
SR 53 at GA 400 SB Ramp	16.7	16.9	B	B
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	11.2	18.8	B	B
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	21.2	17.6	C	B
SR 136 at GA 400 NB Ramp	13.4	18.5	B	B
SR 136 at GA 400 SB Ramp	8.5	8.3	A	A
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	13.8	15.6	B	B
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	12.2	12.6	B	B
SR 60 at GA 400 NB Ramp	27.8	43.2	C	D
SR 60 at GA 400 SB Ramp	20.2	15.0	C	B

Findings and Observations

- During the morning peak hours, GA 400 northbound and GA 400 southbound traffic operate at level of service of C or better and E or better respectively
- The level of service of E along GA 400 southbound between Browns Bridge Road (SR 369) and Keith Bridge Road (SR 306) is due to significant traffic from Browns Bridge Road (SR 369) and heavy exiting traffic on to Keith Bridge Road (SR 306) and queue spill back on to the mainline. This could be eliminated by providing an acceleration lane for the heavy right turn movement at the ramp intersection

- Spill back from the heavy westbound left turn movement (1950 vph) during the morning peak hours at GA 400 southbound ramp results in long queue lengths and thereby resulting in significant upstream intersection and arterial segment delays
- During the afternoon peak hours, GA 400 northbound and GA 400 southbound freeway segments operate at level of service of D or better and B or better respectively with the exception of the freeway segment south of Keith Bridge Road (SR 306) which operates at a level of service of F. Approximately 31 percent of the traffic exit at this interchange and thus a combination of capacity deficiency, spillback from the off ramp on to the mainline results in increase in density along the mainline and hence experience a poor level of service
- The ramp junctions perform at level of service of D or better during the morning and afternoon peak hours except at Keith Bridge Road (SR 306) due to the spillback from heavy right turning movement, which can be minimized by providing an acceleration lane
- All the intersections at the interchanges except for Keith Bridge Road (SR 306) at GA 400 operate at a level of service of D or better during the morning and afternoon peak hours
- The simulation based analysis indicates that providing eastbound acceleration lanes at Keith Bridge Road (SR 306) at GA 400 northbound ramp, Settingdown Road at GA 400 northbound ramp and SR 60 at GA 400 northbound ramps would aid in free flow traffic and thereby significantly reduce the effect of spillback on the mainline. The eastbound acceleration lane at Keith Bridge Road (SR 306) could potentially serve as a third through lane and be dropped at Browns Bridge Road (SR 369) as a right turn lane to improve the traffic operations.
- Keith Bridge Road (SR 306), Browns Bridge Road (SR 369), Settingdown Road, and Hubbard Town Road together contribute approximately 55 percent of the traffic in the peak direction. At a macroscopic level, the traffic volume along GA 400 in the peak direction, north of SR 53 is significantly less as compared to traffic volume south of SR 53
- The travel time along the corridor is summarized in Table 8

Table 8. Future Year 2030 Mainline Travel Time Summary for Six Lane Scenario

Freeway Segment	Travel Time in Minutes	
	AM	PM
GA 400 NB, South of Keith Bridge Road (SR 306) to SR 60	18.3	19.5
GA 400 SB, SR 60 to South of Keith Bridge Road (SR 306)	19.1	18.4

Scenario 2: Eight lane freeway system between Keith Bridge Road (SR 306) and SR 60

Under this scenario, GA 400 will operate as a freeway system with 4 lanes in each direction, between Keith Bridge Road (SR 306) and SR 60. The frontage road between Whitmire Drive / Carlisle Road and SR 53 is analyzed as 2 lanes in each direction.

There are no major improvements to the number of lanes along the side streets within the study area except at SR 53 and Browns Bridge Road (SR 369) in the vicinity of GA 400. The number of turn lanes and the turn bay lengths at the ramp terminal intersections were estimated in accordance with Highway Capacity Methodology (HCM) and American Association of State Highway and Transportation Officials (AASHTO). All the ramp terminal intersections under this scenario are analyzed as signalized intersections. Additionally, acceleration lanes for the heavy right turn movements at some of these intersections were provided, as needed, to improve traffic operations. The minimum length of acceleration and deceleration lanes along GA 400 was based on Highway Capacity Methodology (HCM), longer deceleration lengths were based on the heavy exiting traffic volumes. These assumptions were used to build the traffic simulation model. The future year 2030 volumes, developed by PBS&J, and free flow speed are the other data inputs to the simulation model.

The density and the corresponding level of service for the freeway segments and the ramp junctions for morning and afternoon peak hours are summarized in Tables 9 to 12. The vehicle delay during the morning and afternoon peak-hour based on each approach are summarized in Tables 13. The intersection delay and the corresponding levels of service during the morning and afternoon peak-hours at the signalized intersections are summarized in Table 14. The delays are in terms of average vehicular delay per vehicle at a particular intersection. The level of service provides a qualitative assessment of traffic conditions, based on the average delay and density.

Table 9. Future Year 2030 AM GA 400 Mainline Level of Service Summary for Eight Lane Scenario

Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	13.8	24	B	C
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	10.3	21.2	A	C
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	9.4	19.4	A	C
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	8.7	18.4	A	C
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	7.9	18.1	A	C
GA 400, Between Dawson Forest Road (SR 318) and SR 53	6.6	15.1	A	B
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	8.7	17.9	A	B
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	7.7	15.6	A	B
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	6.6	12.5	A	B
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	5.5	11.8	A	B

Table 10. Future Year 2030 AM Merge, Diverge and Weaving Level of Service Summary for Eight Lane Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	12	21	B	C
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	10	24	A	C
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	11	19	B	B
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	8	18	A	B
GA 400 Off Ramp at Settingdown Road	Diverge	9	18	A	B
GA 400 On Ramp at Settingdown Road	Merge	8	18	A	B
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	9	18	A	B
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	7	17	A	B
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	8	-	A	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	17	-	B
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	7	14	A	B
GA 400 On Ramp at Dawson Forest Road	Merge	6	-	A	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	15	-	B
GA 400 Off Ramp SR 53	Diverge	7	19	A	B
GA 400 On Ramp at SR 53	Merge	9	14	A	B
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	9	15	A	B
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	7	17	A	B
GA 400 Off Ramp at SR 136	Diverge	8	12	A	B
GA 400 On Ramp at SR 136	Merge	6	15	A	B
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	7	12	A	B
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	5	12	A	B
GA 400 Off Ramp at SR 60	Diverge	6	12	A	B
GA 400 On Ramp at SR 60	Merge	5	15	A	B

Table 11. Future Year 2030 PM GA 400 Mainline Level of Service Summary for Eight Lane Scenario

Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	43.5	7.7	E	A
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	25.2	8.6	C	A
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	23.5	9.4	C	A
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	19.6	10.2	C	A
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	20.8	7	C	A
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	16	7.2	B	A
GA 400, Between Dawson Forest Road (SR 318) and SR 53	16	7.1	B	A
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	17.2	7.2	B	A
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	14.4	8	B	A
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	11	9.4	A	A
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	9.4	12.4	A	B

Table 12. Future Year 2030 PM Merge, Diverge and Weaving Level of Service Summary for Eight Lane Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	54	10	E	A
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	24	12	C	B
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	27	8	C	A
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	21	9	C	A
GA 400 Off Ramp at Settingdown Road	Diverge	24	7	C	A
GA 400 On Ramp at Settingdown Road	Merge	20	8	B	A
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	23	7	C	A
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	20	7	B	A
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	22	-	C	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	7	-	A
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	16	7	B	A
GA 400 On Ramp at Dawson Forest Road	Merge	15	-	B	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	7	-	A
GA 400 Off Ramp SR 53	Diverge	17	11	B	B
GA 400 On Ramp at SR 53	Merge	16	7	B	A
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	18	9	B	A
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	13	10	B	A
GA 400 Off Ramp at SR 136	Diverge	15	8	B	A
GA 400 On Ramp at SR 136	Merge	10	9	A	A
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	11	7	B	A
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	9	8	A	A
GA 400 Off Ramp at SR 60	Diverge	11	9	B	A
GA 400 On Ramp at SR 60	Merge	8	9	A	A

Table 13. Future Year 2030 Approach Delay Summary for Eight Lane Scenario

Signalized Intersection	2030 AM				2030 PM			
	Delay (Sec / Veh)				Delay (Sec / Veh)			
	NB	SB	EB	WB	NB	SB	EB	WB
SR 306 at GA 400 NB Ramp	19.3	0.0	17.6	149.0	96.0	0.0	28.9	57.6
SR 306 at GA 400 SB Ramp	0.0	51.6	67.0	125.3	0.0	69.2	34.5	31.2
SR 369 at GA 400 NB Ramp	34.7	0.0	9.6	11.2	28.7	0.0	14.4	17.4
SR 369 at GA 400 SB Ramp	0.0	38.4	19.3	17.3	0.0	29.5	10.3	9.6
Settingdown Rd at GA 400 NB Ramp	15.7	0.0	14.5	6.8	16.1	0.0	21.3	17.1
Settingdown Rd at GA 400 SB Ramp	0.0	14.8	11.9	24.2	0.0	18.8	11.5	28.3
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	68.8	0.0	16.5	17.3	2.1	0.0	35.0	28.7
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	0.0	35.8	12.8	25.5	0.0	10.7	16.8	18.4
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	24.2	0.0	10.9	9.3	10.5	0.0	24.7	-1.1
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	0.0	27.5	8.1	10.4	0.0	22.1	16.8	13.8
Dawson Forest Road (SR 318) at Frontage Rd NB	35.1	0.0	11.0	10.5	12.6	0.0	23.7	9.5
Dawson Forest Road (SR 318) at Frontage Rd SB	0.0	30.4	11.4	12.3	0.0	1.0	3.8	10.4
Industrial Park Rd (SR 318) at Frontage Rd NB	19.0	0.0	7.0	5.3	15.1	0.0	0.5	14.1
Industrial Park Rd (SR 318) at Frontage Rd SB	0.0	26.7	8.0	8.6	0.0	20.9	13.8	33.4
SR 53 at GA 400 NB Ramp	26.1	0.0	11.2	11.7	0.8	0.0	9.0	5.7
SR 53 at GA 400 SB Ramp	0.0	32.4	9.9	9.2	0.0	30.2	1.2	26.8
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	34.7	0.0	8.1	3.6	4.1	0.0	7.6	19.7
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	0.0	19.7	9.8	24.3	0.0	12.5	25.4	23.8
SR 136 at GA 400 NB Ramp	23.2	0.0	11.7	5.4	23.5	0.0	5.0	21.1
SR 136 at GA 400 SB Ramp	0.0	24.4	7.3	8.3	0.0	17.8	4.2	11.4
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	21.8	0.0	12.1	8.6	4.0	0.0	24.4	14.3
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	0.0	22.9	7.0	12.0	0.0	12.7	0.4	7.5
SR 60 at GA 400 NB Ramp	36.6	0.0	14.6	37.5	0.1	0.0	-0.5	35.1
SR 60 at GA 400 SB Ramp	0.0	33.8	13.9	24.2	0.0	7.4	45.8	30.3

Table 14. Future Year 2030 Intersection Capacity Analysis Summary for Eight Lane Scenario

Signalized Intersection	Delay (Sec / Veh)		LOS	
	AM	PM	AM	PM
SR 306 at GA 400 NB Ramp	90.3	63.7	F	F
SR 306 at GA 400 SB Ramp	96.8	36.3	F	D
SR 369 at GA 400 NB Ramp	14.3	18.9	B	B
SR 369 at GA 400 SB Ramp	21.2	11.5	C	B
Settingdown Rd at GA 400 NB Ramp	10.9	18.4	B	B
Settingdown Rd at GA 400 SB Ramp	18.8	18.8	B	B
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	30.9	23.2	C	C
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	23.6	14.3	C	B
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	14.3	9.4	B	A
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	16.7	17.5	B	B
Dawson Forest Road (SR 318) at Frontage Rd NB	18.7	15.6	B	B
Dawson Forest Road (SR 318) at Frontage Rd SB	16.4	5.6	B	A
Industrial Park Rd (SR 318) at Frontage Rd NB	10.1	10.9	B	B
Industrial Park Rd (SR 318) at Frontage Rd SB	17.5	23.0	B	C
SR 53 at GA 400 NB Ramp	15.3	5.2	B	A
SR 53 at GA 400 SB Ramp	16.7	23.7	B	C
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	11.9	8.6	B	A
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	21.1	21.0	C	C
SR 136 at GA 400 NB Ramp	13.5	15.2	B	B
SR 136 at GA 400 SB Ramp	9.4	8.4	A	A
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	13.5	11.6	B	B
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	12.5	8.3	B	A
SR 60 at GA 400 NB Ramp	32.3	2.5	D	A
SR 60 at GA 400 SB Ramp	20.6	24.8	C	C

Findings and Observations

- During the morning peak hours, GA 400 northbound and GA 400 southbound traffic operate at level of service of B or better and C or better respectively
- Spill back from the heavy westbound left turning movement (2010 vph) during the morning peak hours at GA 400 SB Ramp results in long queue lengths and thereby resulting in significant upstream intersection and arterial segment delays

- During the afternoon peak hours, GA 400 northbound and GA 400 southbound freeway segments operate at level of service of C or better and B or better respectively with the exception of the freeway segment south of Keith Bridge Road (SR 306) which operates at a level of service of E. The additional capacity provided by the fourth lane offsets the effect of spillback on to the mainline as compared to the six lane scenario.
- The ramp junctions perform at level of service of D or better during the morning and afternoon peak hours except at Keith Bridge Road (SR 306) due to the spillback from heavy right turning movement, which can be minimized by providing an acceleration lane
- All the intersection at the interchanges except for Keith Bridge Road (SR 306) at GA 400 operate at a level of service of C or better during the morning and afternoon peak hours
- The simulation based analysis indicates that providing eastbound acceleration lanes at Keith Bridge Road (SR 306) at GA 400 northbound Ramp, Settingdown Road at GA 400 northbound Ramp and SR 60 at GA 400 northbound ramps aid in free flow traffic and thereby significantly reduces the effect of spillback on the mainline. The eastbound acceleration lane at Keith Bridge Road (SR 306) could potentially serve as a third through lane and be dropped at Browns Bridge Road (SR 369) as a right turn lane to improve the traffic operations.
- Keith Bridge Road (SR 306), Browns Bridge Road (SR 369), Settingdown Road, and Hubbard Town Road together contribute approximately 50 percent of the traffic in the peak direction. At a macroscopic level, the traffic volume along GA 400 in the peak direction, north of SR 53 is significantly less as compared to traffic volume south of SR 53
- The travel time along the corridor is summarized in Table 15

Table 15. Future Year 2030 Mainline Travel Time Summary for Six Lane Scenario

Freeway Segment	Travel Time in Minutes	
	AM	PM
GA 400 NB, South of Keith Bridge Road (SR 306) to SR 60	17.8	18.8
GA 400 SB, SR 60 to South of Keith Bridge Road (SR 306)	18.3	18

- The reduction in travel time between the six lane and the eight lane scenario is not statistically significant. However, the density along the mainline, especially in the vicinity of Keith Bridge Road (SR 306), Browns Bridge Road (SR 369), Settingdown Road, and Hubbard Town Road are significantly reduced due to the additional capacity.

Scenario 3: HOV / Managed Lane Scenario

Under this scenario, GA 400 will operate as a freeway system with four lanes in each direction that includes one HOV / Managed lane in each direction between Keith Bridge Road (SR 306) and Lumpkin Campground / Harmony Church Road. It is assumed that the HOV / Managed lane will operate as a barrier separated system, thus functions like a pipeline system with designated HOV / Managed lane interchanges. The eight lane freeway system transitions to a six lane freeway system between Lumpkin Campground / Harmony Church Road and SR 60. The frontage road between Whitmire Drive / Carlisle Road and SR 53 is analyzed as 2 lanes in each direction.

There are no major improvements to the number of lanes along the side streets within the study area except at SR 60, SR 53 and Browns Bridge Road (SR 369) in the vicinity of GA 400. The number of turn lanes and the turn bay lengths at the ramp terminal intersections were estimated in accordance with Highway Capacity Methodology (HCM) and American Association of State Highway and Transportation Officials (AASHTO). All the ramp terminal intersections for the general purpose lanes under this scenario are analyzed as signalized intersections. The HOV / Managed lane interchanges at Martin Road, Bottom Road, Jot-Em-Down Road operate as Single Point Urban Interchange (SPUI), while Industrial Park Drive and Lumpkin Campground / Harmony Church Road HOV interchanges are stop controlled on the ramp approach and free flow along the mainline. The acceleration lanes for the heavy right turn movements at some of these intersections were provided, as needed, to improve traffic operations. The minimum length of acceleration and deceleration lanes along GA 400 was based on Highway Capacity Methodology (HCM), longer deceleration lengths were based on the heavy exiting traffic volumes. These assumptions were used to build the traffic simulation mode. The future year 2030 volumes, developed by PBS&J and the free flow speed are the other data inputs to the simulation model.

The density and the corresponding level of service for the freeway segments and the ramp junctions for morning and afternoon peak hours are summarized in Tables 16 to 23. The vehicle delay during the morning and afternoon peak-hour based on each approach for the general purpose ramp intersections are summarized in Tables 24. The intersection delay and the corresponding levels of service during the morning and afternoon peak-hours at the general purpose signalized ramp intersections are summarized in Table 25. The delays are in terms of average vehicular delay per vehicle at a particular intersection. Tables 26 and 27 summarize the approach delay summary and the intersection capacity analysis summary at the HOV / Managed lane interchanges. The level of service provides a qualitative assessment of traffic conditions, based on the average delay and density.

Table 16. Future Year 2030 AM GA 400 General Purpose Lane Level of Service Summary for HOV Scenario

Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	16.9	25.6	B	C
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	13.9	19.7	B	C
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	12.3	16.8	B	B
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	12.1	17.1	B	B
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	11.3	16.4	B	B
GA 400, Between Dawson Forest Road (SR 318) and SR 53	9.1	14.5	A	B
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	10.8	18.2	A	C
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	10	16.4	A	B
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	8.9	14	A	B
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	7.7	14	A	B

Table 17. Future Year 2030 AM HOV Lane Level of Service Summary

HOV Lane Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Martin Road	4.6	18.6	A	B
GA 400, Between Martin Road and Bottoms Road	2.3	12.6	A	B
GA 400, Between Bottoms Road and Jot-Em-Down Road	2.3	8.5	A	A
GA 400, Between Jot-Em-Down Road and Industrial Park Drive	2.9	6.4	A	A
GA 400, Between Industrial Park Drive and Lumpkin Campground / Harmony Church Rd	2.1	5	A	A
GA 400, North of Lumpkin Campground / Harmony Church Rd	1.3	3.3	A	A

Table 18. Future Year 2030 AM General Purpose Lane Merge, Diverge and Weaving Level of Service Summary for HOV Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	13.4	19.4	B	B
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	13	24.3	B	C
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	15	16.2	B	B
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	10.2	16.7	B	B
GA 400 Off Ramp at Settingdown Road	Diverge	12.2	17.1	B	B
GA 400 On Ramp at Settingdown Road	Merge	10.8	15	B	B
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	11.6	16.3	B	B
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	10.1	15.5	B	B
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	11.4	-	B	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	14.6	-	B
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	7.9	12.4	A	B
GA 400 On Ramp at Dawson Forest Road	Merge	8.2	-	A	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	15	-	B
GA 400 Off Ramp SR 53	Diverge	9.5	19.5	A	B
GA 400 On Ramp at SR 53	Merge	10.2	12.8	B	B
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	10.6	15.1	B	B
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	8.3	17.8	A	B
GA 400 Off Ramp at SR 136	Diverge	10.1	13.3	B	B
GA 400 On Ramp at SR 136	Merge	7.2	13.6	A	B
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	8.9	13.8	A	B
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	6.7	12.5	A	B
GA 400 Off Ramp at SR 60	Diverge	8.6	11.9	A	B
GA 400 On Ramp at SR 60	Merge	5.3	17.3	A	B

Table 19. Future Year 2030 PM GA 400 General Purpose Lane Level of Service Summary for HOV Scenario

Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Keith Bridge Road (SR 306)	30.9	15.2	D	B
GA 400, Between Keith Bridge Road (SR 306) and Browns Bridge Road (SR 369)	22.8	13.7	C	B
GA 400, Between Browns Bridge Road (SR 369) and Settingdown Road	20.6	9.9	C	A
GA 400, Between Settingdown Road and Hubbard Town / Cross Roads Road	20.6	9.9	C	A
GA 400, Between Hubbard Town / Cross Roads Road and Whitmire Dr / Carlisle Road	18.7	9.8	C	A
GA 400, Between Dawson Forest Road (SR 318) and SR 53	14.6	7.8	B	A
GA 400, Between SR 53 and Lumpkin Campground / Harmony Church Rd	16.2	8.2	B	A
GA 400, Between Lumpkin Campground / Harmony Church Rd and SR 136	13	11.3	B	A
GA 400, Between SR 136 and Burnt Stand Road / Lumpkin County Parkway	9.9	10.8	A	A
GA 400, Between Burnt Stand Road / Lumpkin County Parkway and SR 60	9.3	9.8	A	A

Table 20. Future Year 2030 AM HOV Lane Level of Service Summary

HOV Lane Freeway Segment	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
	NB	SB	NB	SB
GA 400, South of Martin Road	19.5	5.9	B	A
GA 400, Between Martin Road and Bottoms Road	13	4.5	B	A
GA 400, Between Bottoms Road and Jot-Em-Down Road	9.6	3.5	A	A
GA 400, Between Jot-Em-Down Road and Industrial Park Drive	6.5	4	A	A
GA 400, Between Industrial Park Drive and Lumpkin Campground / Harmony Church Rd	4.8	2.7	A	A
GA 400, North of Lumpkin Campground / Harmony Church Rd	3	1.9	A	A

Table 21. Future Year 2030 PM General Purpose Lane Merge, Diverge and Weaving Level of Service Summary for HOV Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Keith Bridge Road (SR 306)	Diverge	25.5	14.8	C	B
GA 400 On Ramp at Keith Bridge Road (SR 306)	Merge	21.1	13.8	C	B
GA 400 Off Ramp at Browns Bridge Road (SR 369)	Diverge	25.2	10.9	C	B
GA 400 On Ramp at Browns Bridge Road (SR 369)	Merge	17.2	12.6	B	B
GA 400 Off Ramp at Settingdown Road	Diverge	20.7	10.4	C	B
GA 400 On Ramp at Settingdown Road	Merge	18.4	10.3	B	B
GA 400 Off Ramp at Hubbard Town / Cross Roads Road	Diverge	20.2	8.6	C	A
GA 400 On Ramp at Hubbard Town / Cross Roads Road	Merge	16.7	10.2	B	B
GA 400 Off Ramp at Whitmire Dr / Carlisle Road	Diverge	18.6	-	B	-
GA 400 On Ramp at Whitmire Dr / Carlisle Road	Merge	-	10.1	-	B
GA 400, Between Whitmire Dr / Carlisle Road and Dawson Forest Road (SR 318)	Weaving	14.7	7.4	B	A
GA 400 On Ramp at Dawson Forest Road	Merge	12.9	-	B	-
GA 400 Off Ramp at Dawson Forest Road	Merge	-	8.7	-	A
GA 400 Off Ramp SR 53	Diverge	15.5	8.6	B	A
GA 400 On Ramp at SR 53	Merge	15.3	7.7	B	A
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	16.5	10.6	B	B
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	10.4	8.1	B	A
GA 400 Off Ramp at SR 136	Diverge	13.8	11.9	B	B
GA 400 On Ramp at SR 136	Merge	8.1	11.8	A	B
GA 400 Off Ramp at Burnt Stand Road / Lumpkin County Parkway	Diverge	9.9	10.9	A	B
GA 400 On Ramp at Burnt Stand Road / Lumpkin County Parkway	Merge	8.2	10.8	A	B
GA 400 Off Ramp at SR 60	Diverge	10.7	10.5	B	B
GA 400 On Ramp at SR 60	Merge	5.5	10.4	A	B

Table 22. Future Year 2030 AM HOV Lane Merge, Diverge and Weaving Level of Service Summary for HOV Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Martin Road	Diverge	3.8	11.9	A	B
GA 400 On Ramp at Martin Road	Merge	1.2	9.6	A	A
GA 400 Off Ramp at Bottoms Road	Diverge	2.1	9.5	A	A
GA 400 On Ramp at Bottoms Road	Merge	1.7	7.9	A	A
GA 400 Off Ramp at Jot-Em-Down Road	Diverge	2.1	6	A	A
GA 400 On Ramp at Jot-Em-Down Road	Merge	2.1	5.9	A	A
GA 400 Off Ramp at Industrial Park Drive	Diverge	2.5	3.7	A	A
GA 400 On Ramp at Industrial Park Drive	Merge	1.4	4.5	A	A
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	1.9	-	A	-
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	-	2.8	-	A

Table 23. Future Year 2030 PM HOV Lane Merge, Diverge and Weaving Level of Service Summary for HOV Scenario

Ramp Junction	Type	Density (Vehicles / Hr / Lane)		Level of Service (LOS)	
		NB	SB	NB	SB
GA 400 Off Ramp at Martin Road	Diverge	16.1	3.8	B	A
GA 400 On Ramp at Martin Road	Merge	7.2	3.5	A	A
GA 400 Off Ramp at Bottoms Road	Diverge	12.2	3.4	B	A
GA 400 On Ramp at Bottoms Road	Merge	7.1	3.3	A	A
GA 400 Off Ramp at Jot-Em-Down Road	Diverge	8.9	2.5	A	A
GA 400 On Ramp at Jot-Em-Down Road	Merge	4.7	3.9	A	A
GA 400 Off Ramp at Industrial Park Drive	Diverge	5.8	2.4	A	A
GA 400 On Ramp at Industrial Park Drive	Merge	3.1	2.4	A	A
GA 400 Off Ramp at Lumpkin Campground / Harmony Church Rd	Diverge	4.3	-	A	-
GA 400 On Ramp at Lumpkin Campground / Harmony Church Rd	Merge	-	1.5	-	A

Table 24. Future Year 2030 Approach Delay Summary for HOV Scenario

Signalized Intersection	2030 AM				2030 PM			
	Delay (Sec / Veh)				Delay (Sec / Veh)			
	NB	SB	EB	WB	NB	SB	EB	WB
SR 306 at GA 400 NB Ramp	18.1	0.0	14.9	12.1	30.5	0.0	17.2	21.5
SR 306 at GA 400 SB Ramp	0.0	30.2	30.1	39.0	0.0	66.5	19.6	25.1
SR 369 at GA 400 NB Ramp	31.3	0.0	7.9	6.5	29.0	0.0	12.9	9.9
SR 369 at GA 400 SB Ramp	0.0	36.8	11.1	14.3	0.0	27.3	7.2	9.7
Settingdown Rd at GA 400 NB Ramp	18.8	0.0	10.6	3.8	13.1	0.0	10.0	3.9
Settingdown Rd at GA 400 SB Ramp	0.0	14.0	8.4	23.2	0.0	15.9	7.0	42.5
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	30.7	0.0	12.2	10.1	22.8	0.0	12.0	12.2
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	0.0	20.6	7.7	23.4	0.0	18.9	6.4	14.0
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	21.4	0.0	11.0	5.6	20.2	0.0	18.5	7.3
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	0.0	23.3	6.2	9.6	0.0	28.6	10.2	11.4
Dawson Forest Road (SR 318) at Frontage Rd NB	26.5	0.0	10.2	10.6	34.5	0.0	13.9	11.6
Dawson Forest Road (SR 318) at Frontage Rd SB	0.0	33.3	9.1	10.3	0.0	34.8	11.7	13.1
Industrial Park Rd (SR 318) at Frontage Rd NB	22.9	0.0	5.1	5.2	24.2	0.0	8.6	8.7
Industrial Park Rd (SR 318) at Frontage Rd SB	0.0	28.9	6.8	8.0	0.0	30.6	7.8	8.2
SR 53 at GA 400 NB Ramp	27.3	0.0	12.0	11.5	19.8	0.0	16.5	16.8
SR 53 at GA 400 SB Ramp	0.0	27.1	10.0	10.5	0.0	21.3	10.6	9.8
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	43.8	0.0	6.4	2.8	24.8	0.0	10.8	13.4
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	0.0	17.9	8.0	22.5	0.0	19.8	6.8	19.7
SR 136 at GA 400 NB Ramp	20.9	0.0	8.7	4.9	21.7	0.0	16.1	10.8
SR 136 at GA 400 SB Ramp	0.0	20.9	5.5	6.9	0.0	22.6	4.4	7.1
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	25.2	0.0	10.7	7.9	25.4	0.0	13.5	9.7
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	0.0	22.0	6.6	11.8	0.0	22.5	5.8	10.3
SR 60 at GA 400 NB Ramp	49.1	0.0	10.3	11.0	30.7	0.0	25.7	23.5
SR 60 at GA 400 SB Ramp	0.0	39.5	10.5	26.1	0.0	43.5	6.7	21.2

Table 25. Future Year 2030 Intersection Capacity Analysis Summary for HOV Scenario

Signalized Intersection	Delay (Sec / Veh)		LOS	
	AM	PM	AM	PM
SR 306 at GA 400 NB Ramp	14.0	23.8	B	C
SR 306 at GA 400 SB Ramp	35.9	29.2	D	C
SR 369 at GA 400 NB Ramp	12.5	16.0	B	B
SR 369 at GA 400 SB Ramp	15.2	9.5	B	A
Settingdown Rd at GA 400 NB Ramp	9.4	9.6	A	A
Settingdown Rd at GA 400 SB Ramp	16.5	17.8	B	B
Hubbard Town / Cross Roads Road at GA 400 NB Ramp	15.7	16.3	B	B
Hubbard Town / Cross Roads Road at GA 400 SB Ramp	16.8	11.6	B	B
Whitmire Dr / Carlisle Road at GA 400 NB Ramp	13.5	15.0	B	B
Whitmire Dr / Carlisle Road at GA 400 SB Ramp	16.5	19.5	B	B
Dawson Forest Road (SR 318) at Frontage Rd NB	15.1	20.9	B	C
Dawson Forest Road (SR 318) at Frontage Rd SB	17.1	19.7	B	B
Industrial Park Rd (SR 318) at Frontage Rd NB	10.6	12.8	B	B
Industrial Park Rd (SR 318) at Frontage Rd SB	17.1	13.9	B	B
SR 53 at GA 400 NB Ramp	17.1	18.0	B	B
SR 53 at GA 400 SB Ramp	15.3	13.0	B	B
Lumpkin Campground / Harmony Church Rd at GA 400 NB Ramp	11.6	17.4	B	B
Lumpkin Campground / Harmony Church Rd at GA 400 SB Ramp	18.8	14.6	B	B
SR 136 at GA 400 NB Ramp	13.0	18.1	B	B
SR 136 at GA 400 SB Ramp	8.1	7.3	A	A
Burnt Stand Road / Lumpkin County Parkway at GA 400 NB Ramp	13.6	15.4	B	B
Burnt Stand Road / Lumpkin County Parkway at GA 400 SB Ramp	12.5	11.0	B	B
SR 60 at GA 400 NB Ramp	22.9	27.2	C	C
SR 60 at GA 400 SB Ramp	21.0	16.7	C	B

Table 26. Future Year 2030 HOV Interchange Intersection Approach Delay Summary

HOV Interchange Intersection	Traffic Control	2030 AM				2030 PM			
		Delay (Sec / Veh)				Delay (Sec / Veh)			
		NB	SB	EB	WB	NB	SB	EB	WB
Martin Road at GA 400	Signalized	12.2	11.5	6.6	7.8	2.1	0.1	1.8	1.5
Bottoms Road at GA 400	Signalized	10.2	9.2	10.7	11.0	10.4	9.0	8.7	9.5
Jot-Em-Down Road at GA 400	Signalized	8.7	10.9	8.3	18.3	14.4	11.6	11.0	17.8
Industrial Park Drive at GA 400	Unsignalized	7.6	5.9	4.2	3.5	10.7	7.4	3.6	3.5
Lumpkin Campground / Harmony Church Rd at GA 400	Unsignalized	5.1	-	3.0	2.5	8.1	-	2.7	3.7

Table 27. Future Year 2030 HOV Interchange Intersection Capacity Analysis Summary

HOV Interchange Intersection	Traffic Control	Delay (Sec / Veh)		LOS	
		AM	PM	AM	PM
Martin Road at GA 400	Signalized	8.5	1.6	A	A
Bottoms Road at GA 400	Signalized	10.7	9.5	B	A
Jot-Em-Down Road at GA 400	Signalized	13.3	13.9	B	B
Industrial Park Drive at GA 400	Unsignalized	4.6	4.9	A	A
Lumpkin Campground / Harmony Church Rd at GA 400	Unsignalized	2.8	3.7	A	A

Findings and Observations

- During the morning peak hours, GA 400 northbound and GA 400 southbound traffic on the general purpose lane operate at level of service of B or better and C or better respectively
- During the morning peak hours, the HOV / Managed lane operates at a level of service of A or better and B or better respectively along GA 400 northbound and southbound directions respectively
- The spill back that was observed due to the heavy westbound left turning movement during the morning peak hours at GA 400 southbound ramp under the six and eight lane scenarios is eliminated under this scenario on the assumption that there would be significant reduction in the traffic volumes as a result of car pooling
- During the afternoon peak hours, GA 400 northbound and GA 400 southbound freeway segments operate at level of service of D or better and B or better respectively
- The ramp junctions for the general purpose lanes perform at level of service of D or better during the morning and afternoon peak hours
- The ramp junctions for the HOV / Managed lane perform at level of service of B or better during the morning and afternoon peak hours
- All the intersection at the interchanges (both general purpose and HOV / Managed lane) operate at a level of service of C or better during the morning and afternoon peak hours
- Keith Bridge Road (SR 306), Browns Bridge Road (SR 369), Settingdown Road, and Hubbard Town Road together contribute approximately 50 percent of the traffic in the peak direction. At a macroscopic level, the traffic volume along GA 400 in the peak direction, north of SR 53 is significantly less as compared to traffic volume south of SR 53

- The travel time along the corridor is summarized in Tables 28 and 29

Table 28. Future Year 2030 Mainline Travel Time Summary for HOV Scenario

General Purpose Freeway Segment	Travel Time in Minutes	
	AM	PM
GA 400 NB, South of Keith Bridge Road (SR 306) to SR 60	18.2	18.6
GA 400 SB, SR 60 to South of Keith Bridge Road (SR 306)	18.6	17.7

Table 29. Future Year 2030 HOV Lane Travel Time Summary

HOV Freeway Segment	Travel Time in Minutes	
	AM	PM
GA 400 NB, South of Keith Bridge Road (SR 306) to Lumpkin Campground / Harmony Church Rd	10.1	10.5
GA 400 SB, Lumpkin Campground / Harmony Church Rd to South of Keith Bridge Road (SR 306)	10.3	10

- The results of the traffic analysis indicates that the difference in travel time along the entire study corridor between HOV lane and general purpose lane is not significantly different (less than or equal to 0.2 minutes), but the density along the HOV lanes are significantly less as compared to the general purpose lanes. Additionally, the efficiency of the HOV / Managed lane reduces the density on the general purpose freeway segments